METHOD FOR TAKING-OUT SUPERPLASTIC FORMED PRODUCT FROM MOLD

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Abstract

PURPOSE:To provide a formed product take-out method capable of preventing the occurrence of deformation and flaw of a superplastic formed product and taking out the formed product from a mald within a short time with high releas ing property.
CONSTITUTION:After the recessed superplastic formed product 7 is obtained by superplastic-forming a superplastic raw plate 6 by using the mold 11 having a recessed forming part 13, only the formed product 7 is substantially cooled by cooling the inside bottom including the bottom part of the formed goods 7 with a coolant to subject only, the formed product 7 to dimensional shrinkage, then released from the mold 11. The formed product 7 is cooled by using a gas stream or abutting a cooling male mold 21 on the recessed inside surface thereof.

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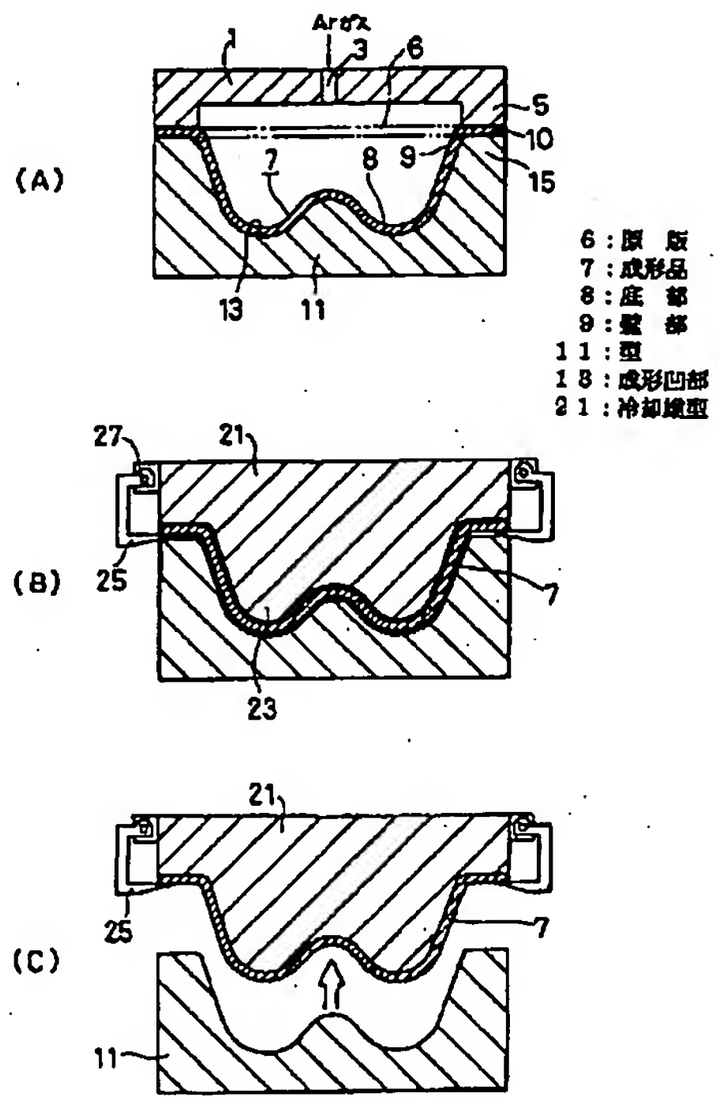
(54)【発明の名称】　超塑性成形品の型からの取出し方法

(57)【要約】

【目的】　超塑性成形品を型から取出す際、成形品の離型性がよく、成形品の変形や傷を防止でき、短時間で成形品の取外しを行うことができるような取出し方法を提供する。

【構成】　超塑性材原板６を、成形凹部１３を有する型１１を用い超塑性成形して凹状の超塑性成形品７を得た後、同成形品７の底部８を含む内面を、同内面側から冷却材を作用させることにより、実質的に成形品７のみを冷却して寸法収縮させ、その後に成形品７を型１１から引離す。冷却方法としては、ガス流を用いる方法や、成形品７の凹状内面に冷却雄型２１を当てる方法がある。



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【特許請求の範囲】

【請求項１】　超塑性材原板を、成形凹部を有する型を用い超塑性成形して凹状の超塑性成形品を得た後、この超塑性成形品を型から取出す方法であって；凹状超塑性成形品の底部を含む内面を、同内面側から冷却材を作用させることにより、実質的に超塑性成形品のみを冷却して寸法収縮させ、その後に超塑性成形品を型から引離すことを特徴とする超塑性成形品の型からの取出し方法。

【請求項２】　上記冷却材を作用させる方法が、ガスの吹き付けによるものである請求項１記載の超塑性成形品の型からの取出し方法。

【請求項３】　上記冷却材を作用させる方法が、低温の定形部材を超塑性成形品内面に近接又は接触させることによるものである請求項１記載の超塑性成形品の型からの取出し方法。

【請求項４】　上記定形部材の周縁部に、超塑性成形品のフランジ部を吊り上げるための吊上げ手段が設けられており、この吊上げ手段を用いて超塑性成形品を型から引離す操作を含む請求項３記載の超塑性成形品の型からの取出し方法。

【請求項５】　上記超塑性成形品が底部に突出部を有し、この突出部を選択的に強冷却する請求項１記載の超塑性成形品の型からの取出し方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、超塑性成形品を超塑性成形後に成形型から取出す方法に関する。特には、短時間で能率よく超塑性成形品を型から取出す方法に関する。

【０００２】

【従来の技術】超塑性とは、ある種の材料、例えばアルミニウム及びその合金、銅及びその合金、ステンレススチール、チタン及びその合金などが、固有の融点より低い特定の温度範囲（アルミニウム：４００～６００℃、チタン及びその合金：約８５０～９５０℃、ステンレススチール：９００～１０５０℃）で、非常に大きい伸び（４００～６０００％）を示す性質をいう。この性質を利用して、複雑な形状の製品、深絞り状製品などを、普通１回の操作で成形加工することを超塑性加工という。そのうち、被加工物の一面からガス（例えばアルゴン）圧を作用させて他面を型に押し付けて成形する方法を超塑性ブロー成形法という。

【０００３】型を用いる超塑性成形においては、成形終了後、超塑性成形品が型に張り付いてしまうことがある。特に、成形品が大形の場合、成形ガス圧が高い場合、抜勾配の小さい場合、成形品の凹凸が多く複雑な場合はこうなりやすい。張り付きが起こると、成形品を型から引き離す作業が必要となる。この際、型と共に成形品が冷えた状態で取り出す場合は、成形品も十分な強度を有するため、成形品の変形という点では何ら問題は無

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い。しかし、作業能率の点からは、連続的に超塑性成形を行う場合は、成形品と型が冷えるのを待って取り出し作業することは、待ち時間及び次の成形加工までの昇温に時間がかかり、生産性が低下するという問題がある。

【０００４】一方、高温での成形品の取り出し作業においては、特に超塑性成形品が０．５～２㎜と薄い場合は、成形品の強度が十分ではなく、取り出し時に成形品が変形することがある。特に、型として金属製のものを用いた場合で、かつ成形ガス圧の高い場合は、超塑性成形品が型表面の微細な凹凸（酸化皮膜や切削跡等）に入り込み、取り出し時にその部分が離型剤では対応できないメカニカルなボンディング及び部分的な化学的結合をおこし、超塑性成形品が変形し易いという問題があった。さらに、大形の成形品においてはクレーン等の機械を用いるため、この問題はより顕著となる。

【０００５】このような問題に対処するため、特開昭５７－９７８３３には次のような方法が提案されている。超塑性金属を超塑性成形後、（イ）　型を開放し、成形品の一部（外側）を露呈させ、（ロ）　なお型中にある成形品の壁部と型の壁部との間によりきつくない関係が得られる程度に成形品を収縮させるに足る期間にわたり、成形品の露呈された一部に、冷却材（空気流）を適用し、型自身がこの冷却により実質的に影響される前に冷却を終了させ、（ハ）　型中に残された成形品の壁部と型との間になお存在する保持力に打ち勝って成形品を型の外部に放出する装置でもって、成形品を打撃し、この打撃は、超塑性材料の弾性限界を超過しないが約１０５００kg/cm²に等しい降伏強さに打撃された超塑性材料を到達させるに足る高速において行う。

【０００６】

【発明が解決しようとする課題】特開昭５７－９７８３３の方法は、「超塑性成形品を冷却収縮させて離型を助ける」という着想を提供した点では注目すべき方法である。しかし、この方法では、次のような問題が未解決である。

①　成形品の一部を、型の成形凹部外に、かつ、空気流を吹き付けやすい格好で露呈させる必要があるため、型の構造が複雑になるとともに、材料歩留が下がる。

②　成形品の一部を、かつ、露呈した外側のみを冷却（空冷）するので、型と成形品の食い込みが一番問題となる成形品の底部を有効に冷却することができなかった。

【０００７】③　上記②のため、成形品の離型性が不十分であり、これに対処して成形品を型から抜くための“打撃によって成形品を型の外部に放出する装置”が必要であった。この装置は、超塑性成形温度（Ｔｉ合金や２相ステンレスの場合は８００°以上）にさらされるため、設計・製作・保守を行う上で特別の配慮・対応を要していた。

④　上記“打撃”に伴い、特に大形でかつ薄肉の成形品

では、成形品が傷付いたり、変形したりするおそれがあった。

【0008】本発明は、超塑性成形品の離型性がよく、超塑性成形品の変形や傷を防止でき、型の温度低下を最少限に押えつつ、かつ短時間で成形品の取外しを行うことができるような超塑性成形品の型からの取出し方法を提供することを目的とする。

【0009】

【課題を解決するための手段】本発明者は様々な実験を行い、成形品と型との離型性との関係を探索した。その結果、超塑性成形品の底部を含む部分の温度を型の温度と相違させることにより、温度低下による収縮率の相違を利用して、超塑性成形品と型との間にせん断力を作用させ、それによって両者を引き放すことを新たに知見して本発明を完成するに至った。

【0010】すなわち、本発明の超塑性成形品の型からの取出し方法は、超塑性材原板を、成形凹部を有する型を用い超塑性成形して凹状の超塑性成形品を得た後、この超塑性成形品を型から取出す方法であって；凹状超塑性成形品の底部を含む内面を、同内面側から冷却材を作用させることにより、実質的に超塑性成形品のみを冷却して寸法収縮させ、その後に超塑性成形品を型から引離すことを特徴とする。

【0011】

【作用】最も冷えにくい超塑性成形品の底部を含む内面を、直接、その内面から冷却することにより、最も効果的に超塑性成形品のみを急冷できる。その結果、超塑性成形品を比較的大きく寸法収縮させることができる。また、底部が寸法収縮すると、周辺の壁部もそれに引張られて型の成形凹部の内側に向って動こうとする。これらの作用によって、超塑性成形品表面と型表面との間にせん断力・引張力が働き、両表面の拘束力が解消される。

【0012】本発明の方法は、特には、超塑性材原板の厚さが2㎜以下の場合が効果的である。また、超塑性成形品の凹形状は、深さに比較して巾が広い（底部が広い）、例えば、巾／深が2以上の場合に有効である。冷却材としては、気体、液体、固体のいずれもが適用できる。

【0013】この方法は、特に超塑性成形品と型の材質が同質のときに効果を発揮する。例えば、2相ステンレスを超塑性成形材とし耐熱鋼を型としたような場合である。アルミ合金を超塑性成形材とし耐熱鋼を型としたような場合は、熱膨張係数が大きく異なるため（アルミ合金31×10^{-6}／℃、耐熱鋼17×10^{-6}／℃）、わずかな冷却で温度低下したときでも収縮量が大きく異なり、その結果、せん断力が作用する。この場合でも、強制的に超塑性成形品のアルミ合金を冷却することにより、より取り出しを容易にすることができる。

【0014】強制的な冷却としては、ガス吹き付けが好適である。ガスの種類は、特に限定されず、素材や成形品の性状に合わせて、空気、窒素、アルゴン等各種ガス、及び、水を噴霧させたものを用いることができる。さらに、冷却を兼ねると共に、ガスと超塑性成形品を反応させて超塑性成形品表面を改質することも可能である。ガス吹き付けの方法としては、超塑性成形後、上型を移動し、上方からノズル等を用いて行うことができる。

【0015】本発明の一態様においては、上記冷却材を作用させるために、低温の定形部材を超塑性成形品内面に近接又は接触させる。例えば、型内に隙間2㎜程度空けて型に沿った銅製の雄型を作成する。この隙間は、①超塑性成形品の収縮代を見込む（超塑性成形品が雄型にかみこんで取り出し不能となることを防止）、②型内に設置したときに、こすったり、ぶつけたりして超塑性成形品が疵ついたり、変形したりするのを防止する、等を考慮して決定する。

【0016】この態様においては、次のような利点がある。①超塑性成形品を均等に冷却することが可能であって、成形品の形状をくずさない。②冷却中に異物が付着することを防止できる（例えばガス冷却では周囲のゴミ等が巻き込まれ成形品に付着し表面品質を悪化させることがある）。なお、雄型の内部を水冷構造として、成形品の取出し後次の成形中に雄型を冷却することにより繰り返し使用が可能となる。

【0017】本発明の一態様においては、上記超塑性成形品が底部に突出部を有し、突出部を選択的に強冷却する。突出部を有する超塑性成形品においては、突出部の周囲を冷却することによって、型と突出部の間に有効にせん断力を作用させることができ、この力によって型と成形品を引き離すことができる。

【0018】

【実施例】以下、図面及び実験結果を参照しつつ説明する。図1は、超塑性成形品内面冷却用の定形部材（冷却雄型）を用いる一実施例において、超塑性成形品を取出す方法を示す図である。（A）は、成形が完了して天板を移動させている状態を示す。（B）は、冷却雄型を成形品に当てて成形品を冷却している状態を示す。（C）は、成形品を冷却雄型と共に吊り上げている状態を示す。

【0019】図1において、型11は、所望の成形品形状に対応した形状の成形凹部13を有する。成形凹部13の周囲には、フランジ状の挟持部15が設けられている。この挟持部15の上に超塑性原板6を載せて、天板1の周縁の挟持部5で上から押して原板6の周縁部を挟持する。原板6が超塑性成形温度に均熱された段階で、天板1の中央部に開けられているArガス導入孔3からArガスを天板内の原板6の上面の空間に導入する。Arガスの圧力によって原板6は下方へ張り出し、最終的には型11の成形凹部13に密着した形に超塑性ブロー成形される。

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【００２０】この状態で、原板６は成形品７となる。成形品７のうち、型１１の成形凹部１３底面に押し当てられて、凹んだ底面の部分を底部８、型の挟持部１５に挟持された周縁フランジ状の部分をフランジ部１０、フランジ部１０から底部８に至る垂れ下がる部分を壁部９という。

【００２１】図１（B）においては、図１（A）の天板１を取り去った後で、冷却雄型２１が成形品７の上面（内面）に導入される。冷却雄型２１は銅製で、内部流路を流れる水で冷却されている。冷却雄型２１の下部は、成形品７の内面形状に対応した凸状をしており、冷却雄型２１を成形品７内に導入した時に、冷却雄型２１の下表面と成形品７の内表面（上表面）とは、各部で接触する。このため、成形品７からは、幅射や伝導によって熱が奪われ、成形品７の温度は急速に低下する。その結果、成形品７が寸法収縮し、成形品７の内表面と型１１成形凹部１３の表面との間にせん断・引張力が生じ、両表面が離れやすくなる。

【００２２】冷却雄型２１の周縁には、成形品７のフランジ部を引掛けるツメ２５が設けられている。ツメ２５は、冷却雄型２１に取付けられている回動支点２７を中心としてスイングさせることができる。ツメ２５はコの字状をしており、先端は鋭くとがっている。このツメの先端を成形品７のフランジ部１０と型１１の挟持部１５との間に差し込んでやることにより、成形品７を冷却雄型２１に抱かせることができる。そのまま、図１（C）に示されているように、冷却雄型２１を吊り上げれば、成形品７を冷却雄型２１とともに、型１１の外に取出すことができる。ガス冷却を行うときは、成形品７のフランジ部１０の形状に対応する吊り上げリングを作成し、これにツメを取付けることもできる。

【００２３】図２は、底部に突出部を有する成形品における効果的な冷却方法の一実施例を示す図である。成形品４１の底部には、突出部４３（ラクダのコブ状の凸部）が形成されている。このような場合、突出部、さらにはその周辺部を選択的に強冷却すると、離型性が良い。本実施例では、冷却ガスノズル４７から吹き出すガスを突出部４３の内面に吹き当てて冷却している。ノズル４７は、冷却ヘッド４５の所定位置に配置されており、ヘッダ４５を型３１に対して適切に位置決めしてやることにより、ノズル４７と成形品突出部４３との位置合せもできるようになっている。

【００２４】以下、本発明の方法を実施した例（実施例（A）、（B））を説明する。

実施例（A）

以下の条件で超塑性成形を行った。

超塑性成形材料：２相ステンレス鋼（２５Cr－６Ni－３Mo）、板厚０．５㎜

上型　　：耐熱鋼（ＳＵＳ３１０相当）

下型　　：耐熱鋼（ＳＵＳ３１０相当）

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吊り上げリング：耐熱鋼（ＳＵＳ３１０相当）厚み５０㎜

超塑性成形条件

温度　　：９８０℃

ガス　　：Ａｒ

ガス圧力：２１Kg/cm²

超塑性成形終了後、上型を移動し、上方より空気ノズル（圧力６Ｋｇ／ｃｍ²）にて成形品の壁部と底部に空気を１０秒間吹き付けた。この時、超塑性成形品の温度は９００℃に下がり、下型の温度は９８０℃で温度低下はなかった。この結果、容易に超塑性成形品と型を分離することができた。

【００２５】実施例（B）

以下の条件で超塑性成形を行った。

超塑性成形材料：アルミ合金（５０８３Ａ相当）、板厚１．０㎜

上型　　：耐熱鋼（ＳＵＳ３１０相当）

下型　　：耐熱鋼（ＳＵＳ３１０相当）

超塑性成形条件

温度　　：５００℃

ガス　　：Ａｒ

ガス圧力：１５Kg/cm²

超塑性成形終了後、上型を移動し、上方より内部水冷の銅製の雄型を配置して３秒間成形品の熱を吸収させた。この時、成形品の温度は４００℃、下型の温度は４８０℃に下がり、容易に超塑性成形品と型を分離することができた。

【００２６】

【発明の効果】以上の説明から明らかなように、本発明の超塑性成形品の型からの取出し方法は以下の効果を発揮する。

①　型の温度をほとんど下げることなく、超塑性成形品を短時間で取出すことができるので、連続して成形を行う場合の生産能率を著しく向上させることができる。

②　超塑性成形品の離型性がよいので、超塑性成形品に無理な力や打撃を加えることなく成形品を取出すことができる。そのため成形品の変形・打傷を防止できる。

【図面の簡単な説明】

【図１】超塑性成形品内面冷却用の定形部材（冷却雄型）を用いる一実施例において、超塑性成形品を取出す方法を示す図である。（A）は、成形が完了して天板を移動させている状態を示す。（B）は、冷却雄型を成形品に当てて成形品を冷却している状態を示す。（C）は、成形品を冷却雄型と共に吊り上げている状態を示す。

【図２】底部に突出部を有する成形品における効果的な冷却方法の一実施例を示す図である。

【符号の説明】

１　天板　　３　Ａｒガス導入孔

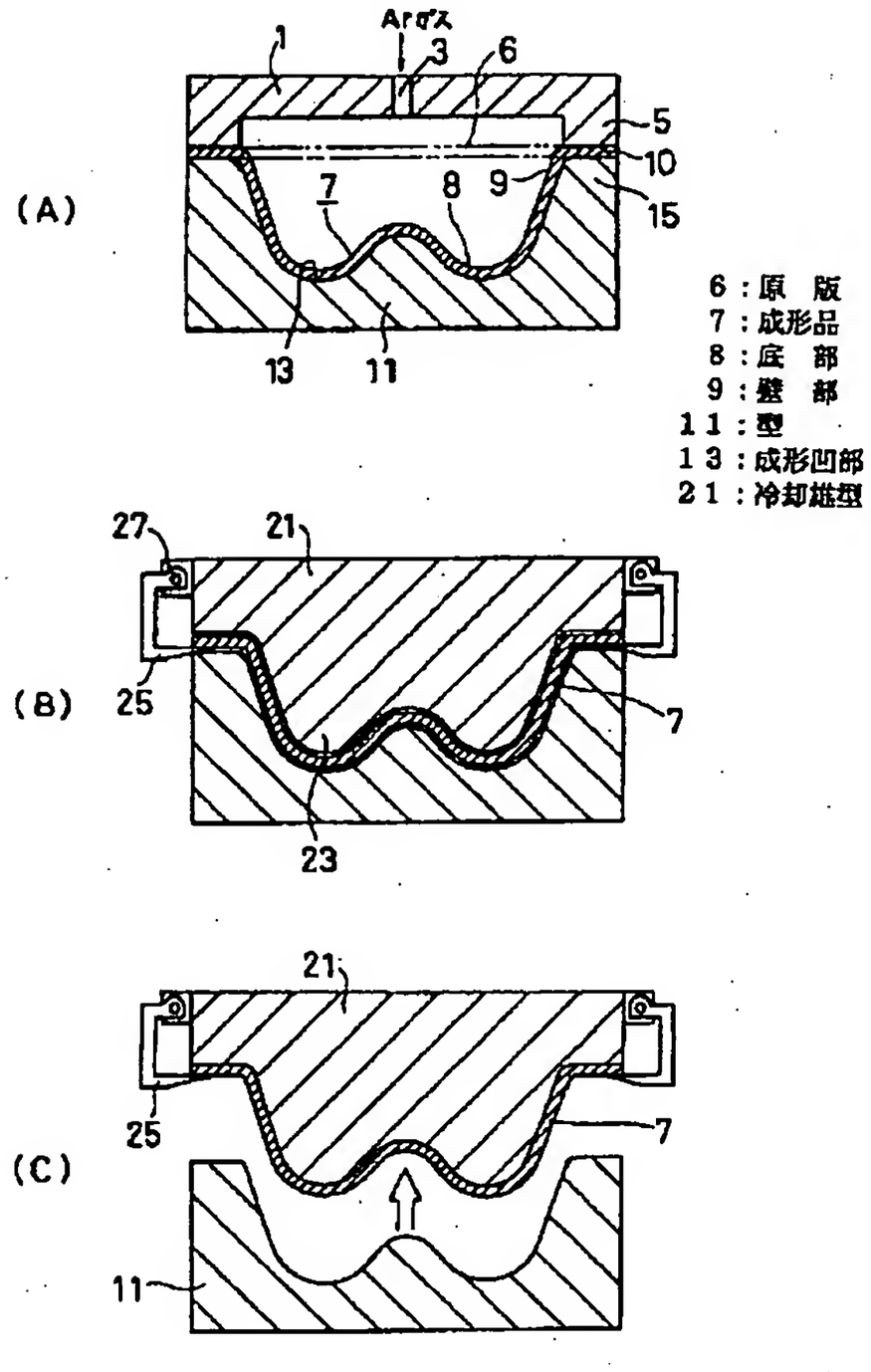
7

5　挟持部
6　原板
7　成形品
8　底部
9　壁部
10　フランジ部
11　型
13　成形凹部
15　挟持部
21　冷却雄型

8

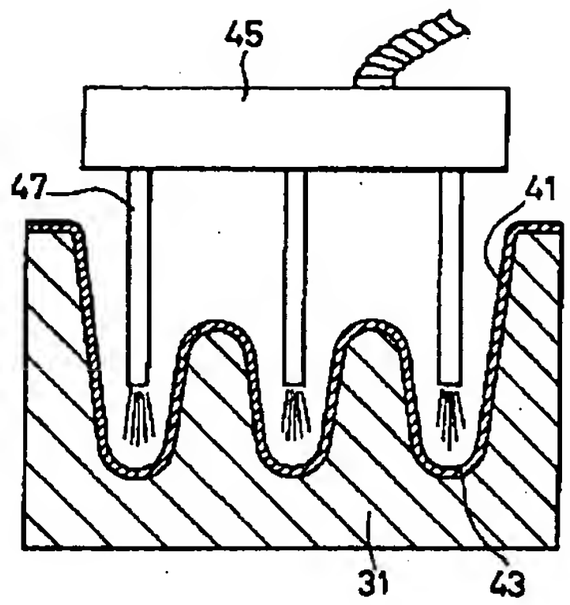
23　凸部
25　ツメ
27　回動支点
31　型
41　成形品
43　突出部
45　冷却ヘッダ
47　冷却ガスノズル

【図１】



6：原　版
7：成形品
8：底　部
9：壁　部
11：型
13：成形凹部
21：冷却雄型

【図２】



PATENT ABSTRACTS OF JAPAN

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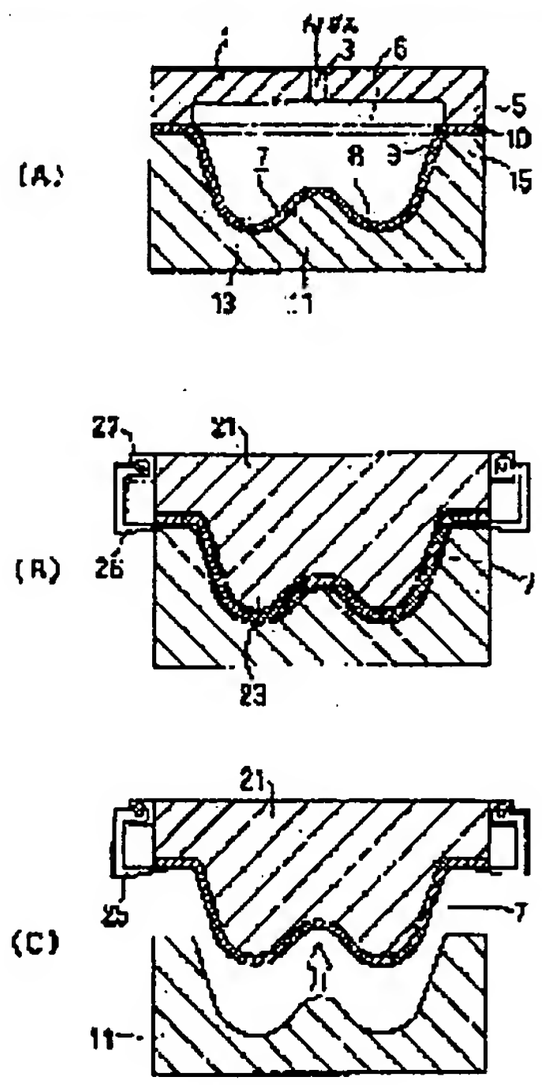
(72)Inventor : **SHIRAKAWA TAKASHI**
TOGE TAKEYA

(54) METHOD FOR TAKING-OUT SUPERPLASTIC FORMED PRODUCT FROM MOLD



(57)Abstract:
PURPOSE: To provide a formed product take-out method capable of preventing the occurrence of deformation and flaw of a superplastic formed product and taking out the formed product from a mald within a short time with high releas ing property.
CONSTITUTION: After the recessed superplastic formed product 7 is obtained by superplastic-forming a superplastic raw plate 6 by using the mold 11 having a recessed forming part 13, only the formed product 7 is substantially cooled by cooling the inside bottom including the bottom part of the formed goods 7 with a coolant to subject only, the formed product 7 to dimensional shrinkage, then released from the mold 11. The formed product 7 is cooled by using a gas stream or abutting a cooling male mold 21 on the recessed inside surface thereof.

CLAIMS

[Claim(s)]
[Claim 1] After carrying out super-elasticity fabrication of the super-elasticity material negative using the mold which has a forming crevice and obtaining concave super-elasticity mold goods, The inside which is the method of picking out these super-elasticity mold goods from a mold, and contains the bottom of; concave super-elasticity mold goods by making a coolant act from this inside side How to take out from the mold of the super-elasticity mold goods which cool only super-elasticity mold goods substantially, are made to carry out size contraction, and are characterized by pulling apart super-elasticity mold goods from a mold after that.
[Claim 2] How to take out from the mold of the super-elasticity mold goods according to claim 1 whose method on which the above-mentioned coolant is made to act is what is depended on blasting of gas.
[Claim 3] How to take out from the mold of the super-elasticity mold goods according to claim 1 which are that by which the method on which the above-mentioned coolant is made to act depends a low-temperature fixed form member on making a super-elasticity mold-goods inside approach or contact.
[Claim 4] the above-mentioned fixed form -- the method of taking out from the mold of super-elasticity mold goods including the operation which the lifting means for lifting the flange of super-elasticity mold goods is prepared in the periphery section of a member, and pulls apart super-elasticity mold goods from a mold using this lifting means according to claim 3
[Claim 5] The way the above-mentioned super-elasticity mold goods have a lobe at the bottom, and take out this lobe from the mold of the super-elasticity mold goods according to claim 1 strong-cooled alternatively.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the method of picking out super-elasticity mold goods from a form block after super-elasticity fabrication. It is related with the method of picking out super-elasticity mold goods from a mold well especially for a short time.
[0002]
[Description of the Prior Art] Super-elasticity means the property in which a certain kind of material, for example, aluminum, and its alloy, copper and its alloy, a stainless steel, titanium, its alloy, etc. are the temperature requirements (aluminum : 400-600 degrees C, titanium, and its alloy : about 850-950 degrees C, a stainless steel : 900-1050 degrees C) of low specification, and show very large elongation (400 - 6000%) from the peculiar melting point. It is called superplasticity forming using this property to usually carry out the fabricating operation of the product of a complicated configuration, the deep-drawing-like product, etc. by one operation. Among those, gas (for example, argon) ** is made to act from the whole surface of a workpiece, and the method of forcing other sides on a mold and fabricating them is called super-elasticity blow molding method.
[0003] In the super-elasticity fabrication using a mold, super-elasticity mold goods may stick to a mold after a forming end. When forming gas pressure is high, and a draft of pattern is small, and there is much irregularity of mold goods and it is complicated, it is especially easy to become, when mold goods are large-sized like this. When a ball up happens, the work which pulls apart mold goods from a mold is needed. Under the present circumstances, since it has intensity also with sufficient mold goods when taking out, after mold goods have got cold with the mold, in respect of deformation of mold goods, it is satisfactory in any way. However, from the point of working capacity, when performing super-elasticity fabrication continuously, waiting, taking out and working that mold goods and a mold get cold requires time for the temperature up to the latency time and the next fabricating operation, and it has the problem that productivity falls.
[0004] On the other hand, in the ejection work of the mold goods in an elevated temperature, when especially super-elasticity mold goods are as thin as 0.5-2mm, the intensity of mold goods may not be enough and mold goods may deform at the time of ejection. When a metal thing was especially used as a mold, and when forming gas pressure was high, super-elasticity mold goods entered into irregularity with a detailed mold front face (an oxide film, the remains of cutting, etc.), the mechanical bonding and a partial chemical combination to which the portion cannot respond by the release agent at the time of ejection were caused, and there was a problem of being easy to transform super-elasticity mold goods. Furthermore, this problem becomes more remarkable in order to use machines, such as a crane, in large-sized mold goods.
[0005] The following methods are proposed by JP,57-97833,A in order to cope with such a problem. They are after

super-elasticity fabrication and (**) about a super-elasticity metal. Open type wide and some mold goods (outside) are made to expose. (b) It continues for the period made sufficient for the grade from which the relation which is not tight is obtained by between the walls of mold goods and the walls of a mold which are in a mold in addition contracting mold goods. Cooling is terminated, before it applies a coolant (airstream) to the part by which mold goods were exposed and the mold itself is substantially influenced by this cooling. (c) It has with the equipment which overcomes the holding power which exists in addition between the walls of mold goods and molds which were left behind into type, and emits mold goods to the exterior of a mold, and mold goods are hit. this blow Although the elasticity limit of super-elasticity material is not exceeded, it carries out in the high speed which is sufficient for making the super-elasticity material hit by the yield strength equal to about 10500 kg/cm2 reach.
[0006]
[Problem(s) to be Solved by the Invention] The method of JP,57-97833,A is a method which should be observed in that the idea of "having carried out cooling contraction of the super-elasticity mold goods, and helping mold release" was offered. However, by this method, the following problems are unsolved.
** some mold goods -- the outside of the forming crevice of a mold -- and in order to make it expose by the appearance which is easy to spray an airstream, while the structure of a mold becomes complicated, stock utilization falls
** some mold goods -- and since only the exposed outside was cooled (air cooling), the bottom of the mold goods with which interlocking of a mold and mold goods poses a problem most was not able to be cooled effectively
[0007] ** Because of the above-mentioned **, the mold-release characteristic of mold goods was inadequate, and "the equipment which emits mold goods to the exterior of a mold by blow" for coping with this and extracting mold goods from a mold was required. This equipment had required special consideration and correspondence, when performing a design, manufacture, and maintenance, since it is exposed to super-elasticity molding temperature (it is 800 degrees or more in Ti alloy and 2 phase stainless steel).
** With the above "a blow", especially, it was large-sized and there was a possibility that mold goods might get damaged or deform, with the mold goods of thin meat.
[0008] this invention aims at offering the method of taking out from the mold of the super-elasticity mold goods which can remove mold goods in a short time, the mold-release characteristic of super-elasticity mold goods being good, being able to prevent deformation of super-elasticity mold goods and a blemish, and pressing down the temperature fall of a mold to the minimum.
[0009]
[Means for Solving the Problem] this invention person conducted various experiments and searched for the relation with the mold-release characteristic of mold goods and a mold. Consequently, by making the temperature of the portion containing the pars basilaris ossis occipitalis of super-elasticity mold goods different from the temperature of a mold, using the difference of the contraction by temperature fall, shearing force was made to act between super-elasticity mold goods and a mold, and the knowledge of lengthening and releasing both by it is newly carried out, and it came to complete this invention.
[0010] Namely, the method of taking out from the mold of the super-elasticity mold goods of this invention After carrying out super-elasticity fabrication of the super-elasticity material negative using the mold which has a forming crevice and obtaining concave super-elasticity mold goods, By making a coolant the inside which is the method of picking out these super-elasticity mold goods from a mold, and contains the bottom of; concave super-elasticity mold goods act from this inside side, only super-elasticity mold goods are cooled substantially, size contraction is carried out, and it is characterized by pulling apart super-elasticity mold goods from a mold after that.
[0011]
[Function] Only super-elasticity mold goods can be most effectively quenched by cooling directly the inside containing the pars basilaris ossis occipitalis of the super-elasticity mold goods which cannot get cold most easily from the inside. Consequently, size contraction of the super-elasticity mold goods can be carried out comparatively greatly. Moreover, if a pars basilaris ossis occipitalis carries out size contraction, a surrounding wall is also pulled by it and tends to move toward the inside of the forming crevice of a mold. Shearing force and tensile force work between a super-elasticity mold-goods front face and a mold front face, and the restraint of both front faces is canceled by these operations.
[0012] Especially the method of this invention has the effective case where the thickness of a super-elasticity material negative is 2mm or less. Moreover, the shape of a concave of super-elasticity mold goods has effective latus (partes basilaris ossis occipitalis are latus), for example, width,/**, when width is two or more as compared with the depth. as a coolant -- both a gas a liquid and a solid-state -- although -- it is applicable
[0013] Especially, this method demonstrates an effect, when the quality of the material of super-elasticity mold goods and a mold is homogeneous. For example, it is a case as 2 phase stainless steel is made into super-elasticity

fabrication material and heat-resisting steel was used as the mold. Since coefficients of thermal expansion differ greatly when an aluminum containing alloy is made into super-elasticity fabrication material and heat-resisting steel is used as a mold (aluminum containing alloy 31x10-6/degree C, heat-resisting steel 17x10-6/degree C), even when a temperature fall is carried out by slight cooling, the amounts of contraction differ greatly, consequently shearing force acts. Even in this case, ejection can be made easy more by cooling the aluminum containing alloy of super-elasticity mold goods compulsorily.

[0014] As compulsory cooling, gas blasting is suitable. Especially the kind of gas is not limited but various gas, such as air, nitrogen, and an argon, and the thing on which water was made to spray can be used for it according to the character of a material or mold goods. Furthermore, while serving as cooling, it is also possible to make gas and super-elasticity mold goods react, and to reform a super-elasticity mold-goods front face. As the method of gas blasting, a punch can be moved after super-elasticity fabrication and it can carry out using a nozzle etc. from the upper part.

[0015] In one mode of this invention, in order to make the above-mentioned coolant act, a low-temperature fixed form member is approached or contacted to a super-elasticity mold-goods inside. For example, the copper male which vacated about 2mm of crevices in the mold, and met the mold is created. it prevents that rub or throw this crevice, and super-elasticity mold goods get damaged or deform it when it installs in ** type which expects the contraction cost of ** super-elasticity mold goods (super-elasticity mold goods bite and are full in a male, and prevent a bird clapper as ejection is impossible) -- it determines in consideration of **

[0016] There are the following advantages in this mode. ** It is possible to cool super-elasticity mold goods equally, and don't break down the configuration of mold goods. ** It can prevent that a foreign matter adheres during cooling (for example, in a gas cooling method, surrounding dust etc. is involved in, it adheres to mold goods, and surface quality may be worsened). In addition, it becomes usable by making the interior of a male into water-cooled structure repeatedly by cooling a male during the next fabrication after extraction of mold goods.

[0017] In one mode of this invention, the above-mentioned super-elasticity mold goods have a lobe at the bottom, and strong-cool a lobe alternatively. In the super-elasticity mold goods which have a lobe, by cooling the circumference of a lobe, shearing force can be made to be able to act effectively between a mold and a lobe, and this force can pull apart a mold and mold goods.

[0018]

[Example] Hereafter, it explains, referring to a drawing and an experimental result. Drawing 1 is drawing showing how to take out super-elasticity mold goods in one example which uses the fixed form member for super-elasticity mold-goods inside cooling (cooling male). (A) shows the state where fabrication is completed and the top plate is moved. (B) shows the state where applied the cooling male to mold goods and mold goods are cooled. (C) shows the state where mold goods are lifted with the cooling male.

[0019] In drawing 1 , a mold 11 has the forming crevice 13 of the configuration corresponding to the desired mold-goods configuration. The flange-like pinching section 15 is formed in the circumference of the forming crevice 13. The super-elasticity negative 6 is carried on this pinching section 15, it pushes from a top in the pinching section 5 of the periphery of a top plate 1, and the periphery section of a negative 6 is pinched. Ar gas introduction which has been opened in the center section of the top plate 1 in the stage where super-elasticity molding temperature soaked the negative 6 -- Ar gas is introduced into the space of the upper surface of the negative 6 in a top plate from a hole 3 A negative 6 is jutted out below with the pressure of Ar gas, and super-elasticity blow molding is carried out to the form finally stuck to the forming crevice 13 of a mold 11.

[0020] In this state, a negative 6 serves as mold goods 7. The portion from a flange 10 and a flange 10 to a pars basilaris ossis occipitalis 8 for the portion of the shape of a periphery flange which was pressed against forming crevice 13 base of a mold 11 among mold goods 7, and was pinched by a pars basilaris ossis occipitalis 8 and the pinching section 15 of a mold in the portion of the depressed base hanging down is called wall 9.

[0021] In drawing 1 (B), after removing the top plate 1 of drawing 1 (A), the cooling male 21 is introduced into the upper surface (inside) of mold goods 7. The cooling male 21 is copper and is cooled with the water which flows internal passage. The lower part of the cooling male 21 is carrying out convex [corresponding to the inside configuration of mold goods 7], and when the cooling male 21 is introduced in mold goods 7, the following table side of the cooling male 21 and the internal surface (upper front face) of mold goods 7 contact in each part. For this reason, heat is taken from mold goods 7 by **** and conduction, and the temperature of mold goods 7 falls quickly. Consequently, mold goods 7 carry out size contraction, shear and tensile force arise between the internal surface of mold goods 7, and the front face of the mold 11 fabrication crevice 13, and it becomes easy to leave both front faces.

[0022] The free wheel pawl 25 which hooks the flange of mold goods 7 is formed in the periphery of the cooling male 21. A free wheel pawl 25 can make the rotation supporting point 27 attached in the cooling male 21 swing as a center. The free wheel pawl 25 is carrying out the shape of a character of KO, and the nose of cam is keenly sharp.

Mold goods 7 can be made to hold in the cooling male 21 by inserting the nose of cam of this free wheel pawl between the flange 10 of mold goods 7, and the pinching section 15 of a mold 11. If the cooling male 21 is then lifted as shown in drawing 1 (C), mold goods 7 can be taken out besides a mold 11 with the cooling male 21. When performing a gas cooling method, the lifting ring corresponding to the configuration of the flange 10 of mold goods 7 can be created, and a free wheel pawl can also be attached in this.

[0023] Drawing 2 is drawing showing one example of the effective cooling method in the mold goods which have a lobe at the pars basilaris ossis occipitalis. The lobe 43 (heights of the shape of a cob of a camel) is formed in the pars basilaris ossis occipitalis of mold goods 41. In such a case, a lobe and a further have a good mold-release characteristic, when the periphery is strong-cooled alternatively. In this example, the gas which blows off from the cooling gas nozzle 47 was blown on the inside of a lobe 43, and it has guessed and cooled. The nozzle 47 is arranged in the predetermined position of the cooling head 45, and it has come to be also able to perform alignment with a nozzle 47 and the mold-goods lobe 43 by positioning a header 45 appropriately to a mold 31.

[0024] Hereafter, the example (an example (A), (B)) which enforced the method of this invention is explained.

Example (A)

Super-elasticity fabrication was performed on condition that the following.

Super-elasticity molding material: 2 phase stainless steel (25Cr-6nickel-3Mo), 0.5mm punch of board thickness : Heat-resisting steel (310 about SUS)

Female mold : heat-resisting steel (310 about SUS)

Lifting ring: Heat-resisting steel (310 about SUS) thickness super-elasticity process condition temperature of 50mm : 980-degree-C gas : Ar gas pressure: The punch was moved after the 21 kg/cm2 super-elasticity fabrication end, and air was sprayed on the wall and pars basilaris ossis occipitalis of mold goods for 10 seconds in the air nozzle (pressure 6 kg/cm2) from the upper part. At this time, the temperature of super-elasticity mold goods fell at 900 degrees C, and the temperature fall did not have the temperature of female mold at 980 degrees C. Consequently, super-elasticity mold goods and the mold were easily separable.

[0025] Example (B)

Super-elasticity fabrication was performed on condition that the following.

Super-elasticity molding material: An aluminum containing alloy (equivalent to 5083A), 1.0mm punch of board thickness : Heat-resisting steel (310 about SUS)

Female mold : heat-resisting steel (310 about SUS)

Super-elasticity process condition temperature : 500-degree-C gas : Ar gas pressure: A punch is moved after 15kg [/cm] 2 super-elasticity fabrication end, the copper male of internal water cooling has been arranged and the heat of mold goods was made to absorb for 3 seconds from the upper part. At this time, the temperature of 400 degrees C and female mold was able to fall at 480 degrees C, and the temperature of mold goods was able to separate super-elasticity mold goods and the mold easily.

[0026]

[Effect of the Invention] The method of taking out from the mold of the super-elasticity mold goods of this invention demonstrates the following effects so that clearly from the above explanation.

** Since super-elasticity mold goods can be taken out in a short time, without lowering most temperature of type, the rate of productivity in the case of fabricating continuously can be raised remarkably.

** Since the mold-release characteristic of super-elasticity mold goods is good, mold goods can be taken out, without adding the force and a blow with super-elasticity mold goods impossible for. Therefore, deformation and the bruise of mold goods can be prevented.

TECHNICAL FIELD

[Industrial Application] this invention relates to the method of picking out super-elasticity mold goods from a form block after super-elasticity fabrication. It is related with the method of picking out super-elasticity mold goods from a mold well especially for a short time.

PRIOR ART

[Description of the Prior Art] Super-elasticity means the property in which a certain kind of material, for example, aluminum, and its alloy, copper and its alloy, a stainless steel, titanium, its alloy, etc. are the temperature requirements (aluminum : 400-600 degrees C, titanium, and its alloy : about 850-950 degrees C, a stainless steel : 900-1050 degrees C) of low specification, and show very large elongation (400 - 6000%) from the peculiar melting point. It is called superplasticity forming using this property to usually carry out the fabricating operation of the product of a complicated configuration, the deep-drawing-like product, etc. by one operation. Among those, gas (for example, argon) ** is made to act from the whole surface of a workpiece, and the method of forcing other sides on a mold and fabricating them is called super-elasticity blow molding method.

[0003] In the super-elasticity fabrication using a mold, super-elasticity mold goods may stick to a mold after a forming end. When forming gas pressure is high, and a draft of pattern is small, and there is much irregularity of mold goods and it is complicated, it is especially easy to become, when mold goods are large-sized like this. When a ball up happens, the work which pulls apart mold goods from a mold is needed. Under the present circumstances, since it has intensity also with sufficient mold goods when taking out, after mold goods have got cold with the mold, in respect of deformation of mold goods, it is satisfactory in any way. However, from the point of working capacity, when performing super-elasticity fabrication continuously, waiting, taking out and working that mold goods and a mold get cold requires time for the temperature up to the latency time and the next fabricating operation, and it has the problem that productivity falls.

[0004] On the other hand, in the ejection work of the mold goods in an elevated temperature, when especially super-elasticity mold goods are as thin as 0.5-2mm, the intensity of mold goods may not be enough and mold goods may deform at the time of ejection. When a metal thing was especially used as a mold, and when forming gas pressure was high, super-elasticity mold goods entered into irregularity with a detailed mold front face (an oxide film, the remains of cutting, etc.), the mechanical bonding and a partial chemical combination to which the portion cannot respond by the release agent at the time of ejection were caused, and there was a problem of being easy to transform super-elasticity mold goods. Furthermore, this problem becomes more remarkable in order to use machines, such as a crane, in large-sized mold goods.

[0005] The following methods are proposed by JP,57-97833,A in order to cope with such a problem. They are after super-elasticity fabrication and (**) about a super-elasticity metal. Open type wide, some mold goods (outside) are made to expose, and it is a (b). Between the walls of mold goods and the walls of a mold which are in a mold in addition. It continues for the period made sufficient for the grade from which the relation which is not tight is obtained contracting mold goods. Cooling is terminated, before it applies a coolant (airstream) to the part by which mold goods were exposed and the mold itself is substantially influenced by this cooling. (c) It has with the equipment which overcomes the holding power which exists in addition between the walls of mold goods and molds which were left behind into type, and emits mold goods to the exterior of a mold, and mold goods are hit. this blow Although the elasticity limit of super-elasticity material is not exceeded, it carries out in the high speed which is sufficient for making the super-elasticity material hit by the yield strength equal to about 10500 kg/cm2 reach.

EFFECT OF THE INVENTION

[Effect of the Invention] The method of taking out from the mold of the super-elasticity mold goods of this invention demonstrates the following effects so that clearly from the above explanation.

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** Since the mold-release characteristic of super-elasticity mold goods is good, mold goods can be taken out, without adding the force and a blow with super-elasticity mold goods impossible for. Therefore, deformation and the bruise of mold goods can be prevented.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The method of JP,57-97833,A is a method which should be observed in that the idea of "having carried out cooling contraction of the super-elasticity mold goods, and helping mold release" was offered. However, by this method, the following problems are unsolved.

** some mold goods -- the outside of the forming crevice of a mold -- and in order to make it expose by the appearance which is easy to spray an airstream, while the structure of a mold becomes complicated, stock utilization falls
** some mold goods -- and since only the exposed outside was cooled (air cooling), the bottom of the mold goods with which interlocking of a mold and mold goods poses a problem most was not able to be cooled effectively
[0007] ** Because of the above-mentioned **, the mold-release characteristic of mold goods was inadequate, and "the equipment which emits mold goods to the exterior of a mold by blow" for coping with this and extracting mold goods from a mold was required. This equipment had required special consideration and correspondence, when performing a design, manufacture, and maintenance, since it is exposed to super-elasticity molding temperature (it is 800 degrees or more in Ti alloy and 2 phase stainless steel).
** With the above "a blow", especially, it was large-sized and there was a possibility that mold goods might get damaged or deform, with the mold goods of thin meat.
[0008] this invention aims at offering the method of taking out from the mold of the super-elasticity mold goods which can remove mold goods in a short time, the mold-release characteristic of super-elasticity mold goods being good, being able to prevent deformation of super-elasticity mold goods and a blemish, and pressing down the temperature fall of a mold to the minimum.

MEANS

[Means for Solving the Problem] this invention person conducted various experiments and searched for the relation with the mold-release characteristic of mold goods and a mold. Consequently, by making the temperature of the portion containing the bottom of super-elasticity mold goods different from the temperature of a mold, using the difference of the contraction by temperature fall, shearing force was made to act between super-elasticity mold goods and a mold, and the knowledge of lengthening and releasing both by it is newly carried out, and it came to complete this invention.
[0010] Namely, the method of taking out from the mold of the super-elasticity mold goods of this invention After carrying out super-elasticity fabrication of the super-elasticity material negative using the mold which has a forming crevice and obtaining concave super-elasticity mold goods, By making a coolant the inside which is the method of picking out these super-elasticity mold goods from a mold, and contains the bottom of; concave super-elasticity mold goods act from this inside side, only super-elasticity mold goods are cooled substantially, size contraction is carried out, and it is characterized by pulling apart super-elasticity mold goods from a mold after that.

OPERATION

[Function] Only super-elasticity mold goods can be most effectively quenched by cooling directly the inside containing the pars basilaris ossis occipitalis of the super-elasticity mold goods which cannot get cold most easily from the inside. Consequently, size contraction of the super-elasticity mold goods can be carried out comparatively greatly. Moreover, if a pars basilaris ossis occipitalis carries out size contraction, a surrounding wall is also pulled by it and tends to move toward the inside of the forming crevice of a mold. Shearing force and tensile force work between a super-elasticity mold-goods front face and a mold front face, and the restraint of both front faces is canceled by these operations.
[0012] Especially the method of this invention has the effective case where the thickness of a super-elasticity material negative is 2mm or less. Moreover, the shape of a concave of super-elasticity mold goods has effective latus (partes basilaris ossis occipitalis are latus), for example, width,/**, when width is two or more as compared with the depth. as a coolant -- both a gas a liquid and a solid-state -- although -- it is applicable
[0013] Especially, this method demonstrates an effect, when the quality of the material of super-elasticity mold goods and a mold is homogeneous. For example, it is a case as 2 phase stainless steel is made into super-elasticity fabrication material and heat-resisting steel was used as the mold. Since coefficients of thermal expansion differ greatly when an aluminum containing alloy is made into super-elasticity fabrication material and heat-resisting steel is used as a mold (aluminum containing alloy 31x10-6/degree C, heat-resisting steel 17x10-6/degree C), even when

a temperature fall is carried out by slight cooling, the amounts of contraction differ greatly, consequently shearing force acts. Even in this case, ejection can be made easy more by cooling the aluminum containing alloy of super-elasticity mold goods compulsorily.

[0014] As compulsory cooling, gas blasting is suitable. Especially the kind of gas is not limited but various gas, such as air, nitrogen, and an argon, and the thing on which water was made to spray can be used for it according to the character of a material or mold goods. Furthermore, while serving as cooling, it is also possible to make gas and super-elasticity mold goods react, and to reform a super-elasticity mold-goods front face. As the method of gas blasting, a punch can be moved after super-elasticity fabrication and it can carry out using a nozzle etc. from the upper part.

[0015] In one mode of this invention, in order to make the above-mentioned coolant act, a low-temperature fixed form member is approached or contacted to a super-elasticity mold-goods inside. For example, the copper male which vacated about 2mm of crevices in the mold, and met the mold is created. it prevents that rub or throw this crevice, and super-elasticity mold goods get damaged or deform it when it installs in ** type which expects the contraction cost of ** super-elasticity mold goods (super-elasticity mold goods bite to a male, are full and take out to it, and prevent a bird clapper as it is impossible) -- it determines in consideration of **

[0016] There are the following advantages in this mode. ** It is possible to cool super-elasticity mold goods equally, and don't break down the configuration of mold goods. ** It can prevent that a foreign matter adheres during cooling (for example, in a gas cooling method, surrounding dust etc. is involved in, it adheres to mold goods, and surface quality may be worsened). In addition, it becomes usable by making the interior of a male into water-cooled structure repeatedly by cooling a male during the next fabrication after extraction of mold goods.

[0017] In one mode of this invention, the above-mentioned super-elasticity mold goods have a lobe at the pars basilaris ossis occipitalis, and strong-cool a lobe alternatively. In the super-elasticity mold goods which have a lobe, by cooling the circumference of a lobe, shearing force can be made to be able to act effectively between a mold and a lobe, and this force can pull apart a mold and mold goods.

EXAMPLE

[Example] Hereafter, it explains, referring to a drawing and an experimental result. Drawing 1 is drawing showing how to take out super-elasticity mold goods in one example which uses the fixed form member for super-elasticity mold-goods inside cooling (cooling male). (A) shows the state where fabrication is completed and the top plate is moved. (B) shows the state where applied the cooling male to mold goods and mold goods are cooled. (C) shows the state where mold goods are lifted with the cooling male.

[0019] In drawing 1 , a mold 11 has the forming crevice 13 of the configuration corresponding to the desired mold-goods configuration. The flange-like pinching section 15 is formed in the circumference of the forming crevice 13. The super-elasticity negative 6 is carried on this pinching section 15, it pushes from a top in the pinching section 5 of the periphery of a top plate 1, and the periphery section of a negative 6 is pinched. Ar gas introduction which has been opened in the center section of the top plate 1 in the stage where super-elasticity molding temperature soaked the negative 6 -- Ar gas is introduced into the space of the upper surface of the negative 6 in a top plate from a hole 3 A negative 6 is jutted out below with the pressure of Ar gas, and super-elasticity blow molding is carried out to the form finally stuck to the forming crevice 13 of a mold 11.

[0020] In this state, a negative 6 serves as mold goods 7. The portion from a flange 10 and a flange 10 to a pars basilaris ossis occipitalis 8 for the portion of the shape of a periphery flange which was pressed against forming crevice 13 base of a mold 11 among mold goods 7, and was pinched by a pars basilaris ossis occipitalis 8 and the pinching section 15 of a mold in the portion of the depressed base hanging down is called wall 9.

[0021] In drawing 1 (B), after removing the top plate 1 of drawing 1 (A), the cooling male 21 is introduced into the upper surface (inside) of mold goods 7. The cooling male 21 is copper and is cooled with the water which flows internal passage. The lower part of the cooling male 21 is carrying out convex [corresponding to the inside configuration of mold goods 7], and when the cooling male 21 is introduced in mold goods 7, the following table side of the cooling male 21 and the internal surface (upper front face) of mold goods 7 contact in each part. For this reason, heat is taken from mold goods 7 by **** and conduction, and the temperature of mold goods 7 falls quickly. Consequently, mold goods 7 carry out size contraction, shear and tensile force arise between the internal surface of mold goods 7, and the front face of the mold 11 fabrication crevice 13, and it becomes easy to leave both front faces.

[0022] The free wheel pawl 25 which hooks the flange of mold goods 7 is formed in the periphery of the cooling

male 21. A free wheel pawl 25 can make the rotation supporting point 27 attached in the cooling male 21 swing as a center. The free wheel pawl 25 is carrying out the shape of a character of KO, and the nose of cam is keenly sharp. Mold goods 7 can be made to hold in the cooling male 21 by inserting the nose of cam of this free wheel pawl between the flange 10 of mold goods 7, and the pinching section 15 of a mold 11. If the cooling male 21 is then lifted as shown in drawing 1 (C), mold goods 7 can be taken out besides a mold 11 with the cooling male 21. When performing a gas cooling method, the lifting ring corresponding to the configuration of the flange 10 of mold goods 7 can be created, and a free wheel pawl can also be attached in this.

[0023] Drawing 2 is drawing showing one example of the effective cooling method in the mold goods which have a lobe at the pars basilaris ossis occipitalis. The lobe 43 (heights of the shape of a cob of a camel) is formed in the pars basilaris ossis occipitalis of mold goods 41. In such a case, a lobe and a further have a good mold-release characteristic, when the periphery is strong-cooled alternatively. In this example, the gas which blows off from the cooling gas nozzle 47 was blown on the inside of a lobe 43, and it has guessed and cooled. The nozzle 47 is arranged in the predetermined position of the cooling head 45, and it has come to be also able to perform alignment with a nozzle 47 and the mold-goods lobe 43 by positioning a header 45 appropriately to a mold 31.

[0024] Hereafter, the example (an example (A), (B)) which enforced the method of this invention is explained.

Example (A)

Super-elasticity fabrication was performed on condition that the following.

Super-elasticity molding material: 2 phase stainless steel (25Cr-6nickel-3Mo), 0.5mm punch of board thickness : Heat-resisting steel (310 about SUS)

Female mold : heat-resisting steel (310 about SUS)

Lifting ring: Heat-resisting steel (310 about SUS) thickness super-elasticity process condition temperature of 50mm : 980-degree-C gas : Ar gas pressure: The punch was moved after the 21 kg/cm2 super-elasticity fabrication end, and air was sprayed on the wall and pars basilaris ossis occipitalis of mold goods for 10 seconds in the air nozzle (pressure 6 kg/cm2) from the upper part. At this time, the temperature of super-elasticity mold goods fell at 900 degrees C, and the temperature fall did not have the temperature of female mold at 980 degrees C. Consequently, super-elasticity mold goods and the mold were easily separable.

[0025] Example (B)

Super-elasticity fabrication was performed on condition that the following.

Super-elasticity molding material: An aluminum containing alloy (equivalent to 5083A), 1.0mm punch of board thickness : Heat-resisting steel (310 about SUS)

Female mold : heat-resisting steel (310 about SUS)

Super-elasticity process condition temperature : 500-degree-C gas : Ar gas pressure: A punch is moved after 15kg [/cm] 2 super-elasticity fabrication end, the copper male of internal water cooling has been arranged and the heat of mold goods was made to absorb for 3 seconds from the upper part. At this time, the temperature of 400 degrees C and female mold was able to fall at 480 degrees C, and the temperature of mold goods was able to separate super-elasticity mold goods and the mold easily.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] In one example using the fixed form member for super-elasticity mold-goods inside cooling (cooling male), it is drawing showing how to take out super-elasticity mold goods. (A) shows the state where fabrication is completed and the top plate is moved. (B) shows the state where applied the cooling male to mold goods and mold goods are cooled. (C) shows the state where mold goods are lifted with the cooling male.

[Drawing 2] It is drawing showing one example of the effective cooling method in the mold goods which have a lobe at the pars basilaris ossis occipitalis.

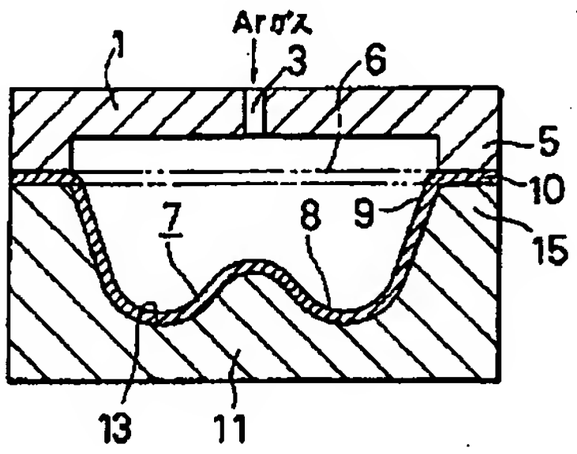
[Description of Notations]

1 Top Plate 3 Ar Gas Introduction -- Hole
5 Pinching Section 6 Negative
7 Mold Goods 8 Pars Basilaris Ossis Occipitalis
9 Wall 10 Flange
11 Mold 13 Forming Crevice
15 Pinching Section 21 Cooling Male
23 Heights 25 Free Wheel Pawl

27 Rotation Supporting Point 31 Type
41 Mold Goods 43 Lobe
45 Cooling Header 47 Cooling Gas Nozzle

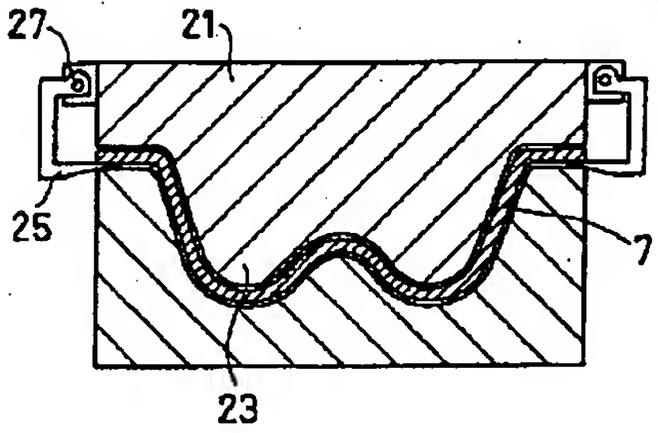
Drawing selection drawing 1

(A)



6：原　版
7：成形品
8：底　部
9：壁　部
11：型
13：成形凹部
21：冷却雄型

(B)



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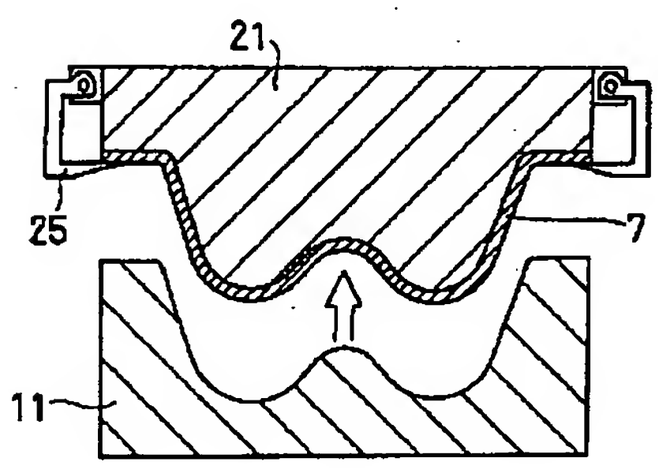
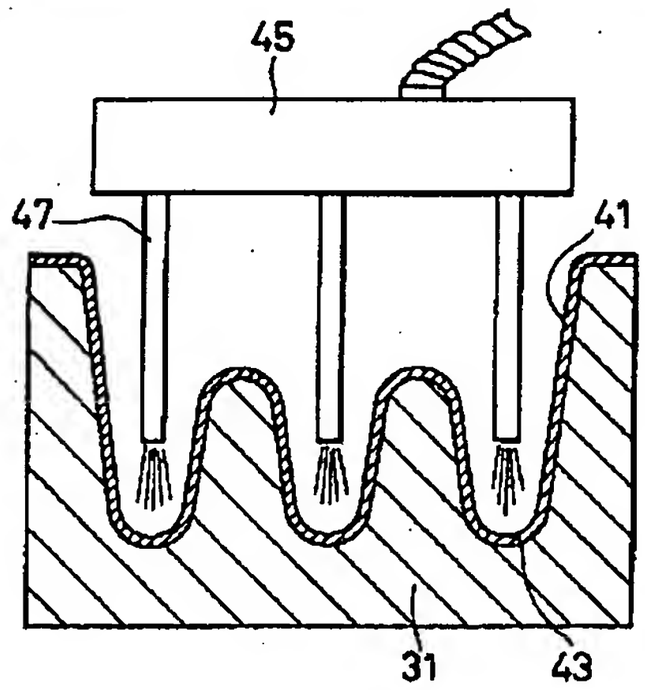


[Translation done.]

Drawing selection drawing 2



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